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ABSTRACT

This working paper is the result of a 1-day colloquium on distance learning, and its basic purpose is to give specialists in distance learning a better understanding of the rapid changes occurring in telecommunications technology and policy and their implications for the future of distance learning. The first of four sections of the paper provides an overview of the interaction between telecommunications technology and policy and distance learning, and gives examples of ways in which these technologies and the services based upon them can be used to support distance learning. Technological changes are addressed in the second section, and the third outlines nine broad policy issues illustrative of the scope and depth of the telecommunications policy issues that may affect the delivery systems available to provide distance education. The last section suggests ways that educators and distance learning specialists can influence the outcome of the telecommunications policy debates. A list of participants in the colloquium concludes this report. (DB)

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DISTANCE LEARNING

OPPORTUNITIES IN TELECOMMUNICATIONS POLICY AND TECHNOLOGY

A Working Paper

by Lynne Gallagher

and Dale Hatfield

THE ANNENBERG WASHINGTON PROGRAM

Communications Policy Studies
Northwestern University

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The Annenberg Washington Program, now in its seventh year, assesses how communications technologies and current public policies on communications affect aspects of American life, including education, medicine, law, politics, foreign policy and financial markets. The Program also provides a neutral forum, open to diverse opinion, where interested individuals examine whether current policies serve the public interest. A part of Northwestern University, the Program was established in 1983. Its director is Newton N. Minow, a former chairman of the Federal Communications Commission.

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I. INTRODUCTION

A. Background

The Office of Technology Assessment (OTA) of the U.S. Congress is currently engaged in a broad study of distance learning: OTA is surveying "the opportunities and barriers in the use of telecommunications and other technologies to provide educational services to students in remote locations, and to remove barriers to learning for specific groups and to facilitate the training and professional development of teachers."

This working paper, sponsored by The Annenberg Washington Program as a contribution to OTA's broader investigation of distance learning, focuses on telecommunications policies and regulations that may affect the provision of telecommunications facilities and services to support distance learning in the United States.

This paper aims to address the telecommunications policy and regulatory issues that can facilitate the development of the infrastructure necessary for successful distance learning. More specifically, the paper seeks to (a) identify, at least through examples, telecommunications policy issues that may have significant effects on the evolution of technologies and services to support distance learning, (b) specify the regulatory and policy forums in which these issues will be resolved, (c) identify the range of telecommunications policy choices that are available and the stake that the distance learning field has in those choices, and (d) discuss how stakeholders in distance learning can influence and capitalize on those choices.

In preparation of this paper, we convened a one-day colloquium on distance learning under the auspices of The Annenberg Washington Program on February 16, 1989. The participants' contributions to this report and to each other were substantial. The professionals invited to the colloquium (listed in the back of this report) included specialists in distance learning, communications technology, and telecommunications policy. In one panel, experts with direct experience in the distance learning field described their programs and their requirements in terms of voice, data and image (e.g., video) communications. Technology experts on a second panel responded to these requirements and described the relevant telecommunications technologies and services that are currently available or are on the horizon. The third panel of telecommunications policy experts elaborated on some of the policy issues that will influence the development and availability of those facilities and services.

The colloquium had two basic purposes: first, to give selected specialists in distance learning a better understanding of the rapid changes occurring in telecommunications technology and policy, and second, to give OTA and other participants a better understanding of the implications of these technology and policy changes for the future of distance learning, in the view of professionals in the field.

By way of further background, we should make two important points:

First, we recognize, as do professionals in distance learning, that the primary policy issues influencing the future development of distance learning are educational, not telecommunications issues per se. In other words, making the appropriate telecommunications technologies and services available is necessary but not nearly sufficient to obtain the full benefits of distance learning.

Second, we intend this working paper to be "policy neutral"--it is not our intent to recommend that stakeholders in distance learning adopt any particular stance on telecommunications policy issues that are discussed herein. Rather, we intend to encourage those groups to identify their stakes and pursue their interests accordingly.

B. Overview of the Interaction Between Telecommunications Technology and Policy and Distance Learning

The telecommunications field is currently being fundamentally reshaped by complex interactions between changes in technology and changes in public policy and regulation. These changes, coupled with customers' increased demand for advanced facilities and services, are increasing competition among equipment and service providers.

This state of rapid change creates three fundamental opportunities for the distance learning field.

First, technological advances in telecommunications and related areas can help address critical problems in teaching and learning at all levels, including kindergarten-through-12th grade (K-12). Second, in an open, competitive market of many suppliers, groups involved in distance learning have an increased opportunity to negotiate favorable terms and conditions for the facilities and services they require. Third, despite steps toward deregulation and increased reliance on

marketplace forces, public policy and regulation still has a major influence on suppliers, the technology they employ and the services they offer. Because public policy and regulation remains in a great state of flux, educators still have an opportunity to influence the ground rules for further development of the telecommunications services and facilities that deliver distance learning services.

With regard to the first point, the technological advances that can improve the delivery of educational services to remote or otherwise isolated groups of pupils and teachers will be described in some detail in Section II. It will suffice to state here that these advances can greatly increase the accessibility, capacity, technical quality, diversity, reliability and cost-effectiveness of the delivery systems for distance learning.

With regard to the second point, the ability to negotiate favorable terms and conditions with competing suppliers is enhanced because education is likely to be a major user of telecommunications facilities and services. Together with other cooperating state and local agencies, educational institutions have a substantial amount of buying power that can be leveraged in a competitive market to ensure the availability of flexible, cost-effective systems that meet their particular needs.

The importance of having choices can hardly be overemphasized. Prior to the advent of competition, the education community, like all large users of telecommunications products and services, was essentially limited to the basic public offerings of a single company, namely, AT&T and its Bell System, or to the offerings of AT&T and the independent local exchange carriers in certain areas. This not only limited the technology and service choices available, it also limited the ability of state and local agencies to negotiate favorable rates based upon volume of traffic and long-term commitments to particular services.

Educational groups and other state and local agencies are no longer so limited. The terminal equipment market (i.e., the market for equipment attached to the Public Switched Telephone Network) and the market for other equipment attached to telecommunications networks (e.g., satellite earth stations) has been deregulated for some time and is now intensely competitive. The interstate long-haul telecommunications market (and portions of the intrastate long-haul market in many states) has been opened to competition for some time and is becoming increasingly competitive.

This all means that distance learning groups, and other educational entities more

generally, have an increasing number of choices in terms of the technologies and facilities they employ (e.g, satellite, fiber, and microwave systems), in terms of the services they utilize (voice, data, and video/image), and in terms of the way the facility or service is acquired (e.g., by outright purchase, by long-term lease under a negotiated contract, or on the basis of a carrier's tariff). Even in the latter case, where facilities or services are obtained under tariff, the carriers are demonstrating increased flexibility in rates and terms and conditions for large customers or customers with unique needs. A recent example of this at the federal level is AT&T's Tariff 16, which is aimed at the federal government's new FTS 2000 system.

Although there are myriad choices available in the terminal equipment and large portions of the long-haul market, choices are more limited for short-haul, local communications. Competition in the local exchange and other short-haul markets is often limited by state law or regulations. But even in these situations, there are some alternatives available, especially for larger users. In addition to local telephone company tariffed offerings, companies providing dedicated fiber optic transmission facilities and services have appeared in many large cities such as New York, Washington, Chicago, Boston and San Francisco. Likewise, cable television companies sometimes provide video and other services on their coaxial cable systems. Larger users often have the option of obtaining their own private microwave systems for point-to-point and point-to-multipoint applications. In the latter case, the education community even has special frequencies set aside by the Federal Communications Commission in what is called the Instructional Television Fixed Service (ITFS).

The availability of these choices makes it increasingly feasible for a state government, say, to create a statewide, video education and training network consisting of (a) backbone, long-haul fiber optic transmission facilities, (b) point-to-point microwave to reach communities not connected to the fiber backbone, and (c) point-to-multipoint microwave (i.e., ITFS) to reach individual schools or other locations within the community. Such a network can be created by a mix of common carrier, private carrier and private facilities and services in today's competitive environment. Examples of such systems already exist, and they can be used to provide one-way, broadcast-type services or interactive services using a combination of video and voice facilities.

With regard to the third point, the opportunity of experts in distance learning to influence the policy and regulatory ground rules which will govern further development of telecommunications services and facilities, there are

a number of observations to be made. As alluded to earlier, the telecommunications policy environment remains in a state of flux. Although fundamental issues of public policy (e.g., regarding the role of competition in interstate long-haul transmission) have been resolved at the federal level by the Federal Communications Commission (FCC), other issues within their jurisdiction remain to be resolved. Still others, many of a critical nature, lie outside their jurisdiction--in the hands of state Public Utility Commissions (PUCs) and state legislatures or in the hands of U.S. District Court Judge Greene (as a result of the settlement of the AT&T antitrust case). Moreover, the Congress, as the primary policymaking entity at the national level, is involved in many telecommunications policy issues through its legislative and oversight processes. Likewise, the National Telecommunications and Information Administration (NTIA) in the U.S. Department of Commerce has been an active advocate for the Executive Branch in telecommunications policy matters. Even local governments have a role in issuing cable television franchises and in issuing permits for the use of public rights-of-way for the installation of fiber optic transmission systems.

Examples of major policy issues at the federal level include (a) efforts by the Bell Operating Companies (BOCs) to have Judge Greene lift the so-called Line of Business (LOB) restrictions that constrain their ability to provide information service content, to manufacture terminal and telecommunications network equipment, and to compete in certain portions of the long-haul communications market, (b) FCC proceedings that would allow the BOCs to provide information services without utilizing a separate subsidiary but on the condition that they provide competitors with open, equal and unbundled access to their local networks, (c) FCC proceedings that would replace traditional rate-base/rate-of-return regulation of interstate services offered by AT&T and the local exchange carriers with a new form of price regulation, and (d) proposals before the Congress and the FCC to change the Communications Act of 1934 (As Amended) and relevant rules and regulations to allow local telephone companies to provide cable television service in the same areas where they provide telephone service.

At the state level of government, most state PUCs and, in some cases, state legislatures are now grappling with many of the same types of issues regarding the role of competition and regulation that the federal government has grappled with for more than two decades. Some of the issues represent fundamental philosophical concerns, such as whether the concept of "universal service" should be expanded from telephone service to include access via telecommunications to basic

information resources. Other issues center around the introduction of competition. For example, while all states now allow some form of long-haul competition, many are struggling with the issue of how much competition, if any, should be allowed for traditional local telephone services. They are also trying to deal with how to fairly allocate costs among competitive and monopoly services, and many states are in the process of deregulating competitive services or relaxing the regulation of services that are at least subject to some competition.

In addition, many states have undertaken major studies of their future telecommunications requirements and infrastructure, recognizing that a modern telecommunications system is needed to (a) make their industry competitive both nationally and internationally and (b) to serve important and changing social goals as we move further into the information age. These state proceedings and studies are especially important to educators and groups interested in distance learning because their telecommunications requirements are often at the state and local level rather than at the national level. The proceedings are especially important because they will affect the choices of technology and the prices and terms and conditions under which distance learning delivery systems are available to the education community. It is at the state level where educators can take hold of key policy levers; since education is largely state and local government-controlled, state telecommunications policy should be particularly sensitive to its needs. Here we are discussing education in its broadest sense, including K-12, adult, professional, retraining, remedial, literacy, continuing education and informal learning.

The importance of the state proceedings can be illustrated by two examples. First, and rather simply, the proceedings dealing with deregulation or relaxed regulation may give the local telephone companies more price and service flexibility in responding to Requests for Proposals (RFPs) issued by public agencies. Second, in moving to some form of deregulation, some states are negotiating with the local telephone companies for certain commitments and/or concessions. In California, the principal local exchange carrier, Pacific Bell, has proposed a major modernization of its facilities if the California PUC will grant it certain regulatory concessions.

These federal and state proceedings that have a bearing on distance learning will be addressed in some detail later in this working paper. The thing we want to emphasize here, however, is that the changes in technology and regulation present a dual opportunity for educators. The changes are increasing the opportunity for the

development of cost-effective delivery systems for distance learning and increasing the opportunity for educators to participate in the telecommunications policymaking process. But the education and distance learning communities must make their requirements and needs known to the suppliers (e.g., through the development of comprehensive RFPs) and to the telecommunications policymakers (e.g., through testimony and/or the filing of comments in legislative and regulatory proceedings) if the promise of distance learning is to be realized.

C. Description of the Balance of the Working Paper

The balance of this working paper consists of three sections. Section II provides an overview of the technological changes that are occurring in the telecommunications field. It gives examples of ways these technologies and the services based upon them can be used to support distance learning. The technology descriptions and the examples draw upon material that was developed for and during the colloquium. Section III deals with telecommunications policy issues and their potential impact on distance learning. It consists of two parts. The first part outlines nine examples of broad policy issues or narrower regulatory questions that were presented at the colloquium. They were designed to illustrate the scope and depth of the telecommunications policy issues that may affect the delivery systems available to provide distance education. The second part of Section III deals with policy issues raised by specialists in distance learning at the colloquium. Finally, Section IV briefly summarizes the Working Paper and suggests ways that educators and, in particular, specialists in distance learning can influence the outcome of these telecommunications policy debates.

II. OVERVIEW OF TECHNOLOGICAL CHANGES

The telecommunications infrastructure in the United States can be divided into three parts: First is the long-haul or intercity part that carries telecommunications traffic over long distances. Second is the local distribution or metropolitan area part that carries traffic within a local area and provides connections to or from the long-haul networks. Third is the terminal equipment and on-premises wiring. Note that the transportation infrastructure and the postal system can similarly be divided into these three basic parts.

In telecommunications, broadcast entertainment programming might be carried from a studio to a satellite earth station on a private microwave system (the local distribution part of the network) via a geostationary satellite to a receive-only earth station at a broadcast station (the long-haul part of the network), from the receive-only earth station to the individual home via the television broadcast station (again the local distribution part), and from an antenna on the viewer's roof to a television set via a piece of coaxial cable (the terminal equipment and inside wiring portion of the network). In some cases, however, portions of the usual network are missing entirely; for example, a private network used for in-house training and video teleconferencing might send the satellite signal directly to corporate offices or plants.

The Public Switched Telephone Network can also be divided into these three parts. The long-haul, or long-distance, part includes services and facilities offered by carriers such as AT&T, MCI and Sprint and a host of other fiber, satellite and microwave-based carriers that offer bulk transmission services to other carriers and large customers. The local distribution or metropolitan area part is usually referred to as the local exchange network and the providers of local services are referred to, logically enough, as local exchange carriers (LECs). Local exchange carriers include the Bell Operating Companies (BOCs) and a large number of independent telephone companies. The terminal equipment and on-premises wiring can range from simple "twisted pair" telephone wiring and ordinary handsets to complex, computerized private branch exchanges (PBXs) with specialized user terminals. In the data communications world, it can include complex twisted pair, coaxial cable or fiber optic cable local area networks used for interconnecting computers, terminals and associated devices.

By examining the telecommunications infrastructure in terms of these three basic parts--long distance, local and terminal equipment/on-premises wiring, one can more readily examine today's fundamental technological trends. One is

the move toward total digitization of the network. In a digital network, the signals being transported and switched (e.g., an ordinary voice conversation or facsimile transmission) are carried as a series of on and off pulses call "bits." There are a host of reasons for this trend toward an all-digital network, including improved transmission quality through regeneration rather than amplification of signals at regular intervals, ease of multiplexing and ease of integrating voice, data and image traffic in a single system, economies associated with the integration of transmission, switching and multiplexing, ease of signalling and encryption, lower costs associated with the use of digital logic and memory chips, and many others. Conversion to digital transmission and switching is occurring in many parts of the telecommunications infrastructure.

The second major trend is the greatly increased use of machine-based "intelligence" within telecommunications networks themselves. This increased use of computer power within networks stems from a host of factors, including the rapid decline in the cost of processing power, the desire to give customers new features that range from something as mundane as call-forwarding in the telephone network to the ability to reconfigure an entire private-line data network upon command from a computer terminal, and the pressures to reduce costs by more effectively utilizing capacity. An example of the latter is the use of processing power to reduce the number of bits it takes to transmit a voice or video signal. Another example is the use of advanced signaling and processing power to offer flexible "800" services.

Still another example is the use of the computer power to create "virtual" or "software defined" networks; such networks have been created for both voice and data applications, and their basic advantage is that they allow the creation of networks that mimic private networks while using public network services and facilities. In other words, they try to combine the advantages of a private network with the economies and other advantages associated with using a public network.

A third major trend is the integration of voice, data and image traffic on common facilities, both for transport and, in the future, perhaps increasingly for switching as well. As mentioned above, once analog signals (e.g., voice, facsimile or video teleconferencing) are converted into digital signals, they can be easily combined with the inherently digital output of computers and other office machines and carried on common digital facilities. Perhaps the best known indication of this trend is in the

development of what is called the "Integrated Services Digital Network" (ISDN).

Because the facilities used in the long-haul networks and between telephone company Central Offices in the local network are rapidly being converted to the digital format, the technical implications of ISDN lie largely in the local loop. The local loop is that portion of the local telephone network that reaches from the local exchange carrier's Central Office to the customer's premises. For the most part, this portion of the network still uses analog transmissions over twisted pair, copper cable along with a signaling scheme that is nearly as old as the industry itself. The basic elements of the ISDN concept involve (a) integrated digital transmission in the local loop (i.e., a common digital "pipe"), (b) standardized interfaces for connecting to the digital "pipe," and (c) a signaling channel separate from the channels bearing information, but within the common digital "pipe."

Two sizes of digital "pipes" are currently being implemented in the United States. The first size would accommodate the two-way transmission of 144,000 bits per second (144 kilobits per second, or kbps), and the second would provide for a total of approximately 1.5 million bits per second (1.5 megabits per second, or Mbps). In addition to the signaling channel that could also be used for low-speed data transmission, the 144 kbps standard would allow the simultaneous transmission of two voice conversations or one voice call and one high-speed data call, for example. The 1.5 Mbps standard could carry up to 23 simultaneous voice conversations plus a high-speed signaling channel, or various combinations of voice, data and image signals within the maximum capacity of the "pipe." This latter capacity is sufficient for some video applications (e.g., teleconferencing) but not for the transmission of full-motion video signals. (Full-motion video requires "broadband" transmission; both the 144 kbps and 1.5 Mbps transmission rates are considered "narrowband.")

These two capacities were chosen, in large part, because these transmission rates can be accommodated by ordinary twisted pair copper wire (one pair for 144 kbps and two pair for 1.5 Mbps), although modifications and rearrangements of the existing local loop plant may be necessary. In other words, the size of the "pipe" is constrained by the electrical characteristics of the existing copper-based facilities. Coupled with the digitization and introduction of machine-based intelligence in the remainder of the network, ISDN would permit end-to-end digital connectivity with greatly increased flexibility in terms of the services and control offered to the customer. ISDN is just beginning to be deployed by the Bell Operating Companies, first in field trials and now on a tariffed basis in several localities around

the country. While there are uncertainties about the optimum degree of integration, the speed of deployment, and even the ultimate market acceptance, ISDN could have an important impact on services available for distance learning.

For example, the proponents of ISDN envision the day when a student, confined to his or her home for whatever reason, could be linked to the classroom through the 144 kbps facility described above. With this capacity, the student could engage in a two-way voice conversation with the teacher or fellow students while simultaneously receiving learning materials or even a slow-scan image of the classroom activities. Another arrangement would allow a student to receive classroom instruction over a microwave ITFS channel while responding to questions from the instructor over the ISDN low-speed data/signaling channel using a simple data terminal. (Note that even the low transmission rate (144 kbps) ISDN service would allow other household members to place and receive telephone calls at the same time the student was interacting with the classroom activities over the signaling channel.)

The fourth major trend is the increased use of fiber optic facilities in the telecommunications infrastructure. The principal advantage of fiber optics is the dramatic increase in capacity that it offers. The major long-distance service providers such as AT&T, Sprint and MCI are rapidly introducing fiber in their intercity networks and, as mentioned earlier, there are numerous suppliers of bulk, fiber-based intercity transmission capacity. In many states, there are now extensive fiber optic networks serving principal population centers.

Fiber is also being introduced in the local telephone network, particularly between local Central Offices. In addition to telephone company interoffice applications, fiber is being used to reach very large customers, long-distance carriers and other customers with high capacity (especially digital) requirements. Fiber is also being introduced in the feeder portion of the local loop--i.e., the portion of the local loop closest to the Central Office.

The creation of integrated broadband networks based upon the use of fiber all the way to the home is being discussed in many technical and policy forums and some field trials are already underway. Such facilities would have much greater capacity than local loops with narrowband ISDN based on twisted-pair copper technology. Typically these discussions and tests involve the carriage of both ordinary

telephone services and video entertainment services on a common, broadband, fiber optic facility. The optimum architecture and actual economics of fiber-to-the-home is subject to much debate as are the policy issues surrounding its introduction.

While these trends are developing in the telephone industry, important technical advances are also being made in other areas. For example, cable television companies are actively incorporating fiber optic systems into their networks. In much the same way that local exchange carriers are using fiber, cable television operators are using it for point-to-point runs between "headends" and "hubs," and are beginning to introduce it in the trunk portion of their networks. The use of fiber in this way greatly decreases the number of amplifiers used in sequence along trunk lines, permitting the cable operator to as much as double channel capacity at a relatively low incremental cost. In other words, the cable television operator can supply as much as one billion hertz (1 GHz) of bandwidth to the home while still utilizing existing coaxial cable for the final run to the home. The selective use of fiber by cable systems also allows them to divide their networks into smaller coverage areas, thus allowing increased flexibility in the delivery of programming. For example, using separate fiber trunks to serve smaller neighborhoods within a franchise area permits the cable company to provide specialized programming to, for example, a retirement community. This increased capacity and flexibility of cable systems, coupled with its increased availability in more than 80 percent of American homes, could have important impact on the services that are available to support distance learning.

At the same time high-capacity fiber optic systems are being deployed in many portions of the telecommunications infrastructure, satellite transmission systems have been developing rapidly. Domestically, one principal development has been in the introduction of high-power satellites and extremely efficient earth stations that allow cost-effective service directly to users' premises in sparsely populated areas ("thin routes"). These Very Small Aperture Terminal (VSAT) networks, as they are called, hold particular promise for serving remote or other difficult-to-serve locations. These same improvements in satellite and earth station technology make the delivery of educational programming cost-effective to widely dispersed locations. For example, as was pointed out during our colloquium, IBM uses such a satellite network for in-house education, and the National Technological University (NTU) offers courses leading to fully accredited master's degrees all over the United States using satellite transmission facilities.

A host of other technologies should be noted. Educational institutions use point-to-multipoint microwave in the form of the Instructional Fixed Television Service, already mentioned, to distribute video programming on a local basis. This service has benefited greatly from the rapidly falling cost of the electronic equipment needed to convert the microwave transmissions to the lower frequencies that can be received on a conventional television set. Local ITFS systems can be combined with various long-haul transmission systems to create state-wide and regional networks. Although point-to-point microwave has been displaced in some high-density, intercity applications, it has also benefited from the falling costs and increasing performance of electronic components. It is still useful in certain thin-route applications. Some states, for example, use private microwave networks to distribute educational broadcast programming. Cellular mobile radio is a relatively new technology that is experiencing extremely rapid growth. The dropping costs of the subscriber equipment and the extension of service to rural areas suggests that cellular radio technology may also be useful in providing basic telephone services to rural areas.

This brief review of technological developments and the feedback we received during the colloquium suggest that these advances can, indeed, improve the delivery of educational services to both students and teachers alike. However, the further development and deployment of these technologies, as well as the prices and terms and conditions under which they will be offered, will be significantly influenced by the outcome of various telecommunications policy debates which we address in the next section.

III. TELECOMMUNICATIONS POLICY ISSUES AND IMPLICATIONS FOR DISTANCE LEARNING

A. Introduction

As noted earlier, this section of the working paper addresses current telecommunications policy issues and their potential impact on distance learning. Subsection B outlines nine examples of broad policy issues and narrower regulatory questions that we presented at the colloquium. Section C deals with policy issues raised by specialists in distance learning at the colloquium.

B. Examples of Telecommunications Policy Issues with Possible Implications for Distance Learning

As explained above, the following nine telecommunications policy and regulatory issues were outlined to the participants in the colloquium as a point of departure for further discussion. They were chosen to suggest the scope and depth of the policy issues that may impact the delivery systems that will be available to provide distance education.

1. Should the definition of "universal service" (as the term is used in the telecommunications policy arena) be expanded to include access to basic information services?

In the past, a major goal of telecommunications policy and regulation at both the state and federal level has been to achieve universal telephone service. With that goal largely achieved, ongoing efforts are principally aimed at maintaining universal service in the face of the competitive pressures towards cost-based pricing. So far, that effort appears to be successful even in the face of dislocations caused by AT&T's divestiture of the Bell Operating Companies. New FCC initiatives in this area include the Link Up America and High Cost Fund programs.

Since universal "dial-tone" service largely has been accomplished and because of the growing importance of various telecommunication based information services, there is a concern that the U.S. not be divided into populations of information "haves and have-nots." To combat this, some have advocated that the nation now strive to achieve universal access to basic information services. It could be argued that such universal access would greatly facilitate the delivery of distance learning services. If this is true, then educators may want to join in advocating such concepts. The objective could be simply to assure that all telephone loops in the country

(even those in very rural areas) are capable of carrying 1200 bps data traffic, thereby making a national commitment to deploy narrowband ISDN services to all residences, small businesses and K-12 schools.

2. Should federal and state policymakers and regulators take positive steps to encourage the more rapid and ubiquitous development of the Integrated Services Digital Network?

In the telephone industry, the shift toward ISDN is a major trend. As explained earlier, the industry is completing field trials of the concept and the local exchange carriers are offering the service in selected locations on a regular tariffed basis. The University of West Virginia is installing an ISDN system to meet its on-campus communications needs. As noted in Section II, this technology could be used in a variety of ways in distance learning. For example, a student confined to his or her home due to illness could simultaneously receive an audio feed and slow-scan pictures from his or her regular classroom, and do so on a "dial-up, as-needed" basis. Telephone companies are also offering ISDN services to large customers on a "CENTREX-like" basis. (CENTREX is a Central Office-based telephone company offering that competes with private PBXs on the customer's premises. Rather than using a PBX to route calls among the customer's extensions, the customer would have its internal calls switched at the Central Office.) It is possible that large metropolitan area schools could take advantage of CENTREX-based ISDN to interconnect individual schools and provide connections to selected students who are home- or institution-bound. Such systems could become the basis for innovative distance learning techniques.

The pace and sites of ISDN deployment depend on many things, including factors that are largely controlled by regulators. Depreciation is an obvious example. Faster depreciation schedules would encourage the deployment of ISDN at the expense of higher prices for existing services. Some BOCs have promised to upgrade their systems in rural areas to allow the eventual deployment of ISDN if they receive certain regulatory flexibility. Some states have allowed the local exchange carriers slightly higher rates with the funds generated earmarked to upgrade rural service. These and similar measures could be used to encourage the development of ISDN that would provide the needed facilities and services to distance education.

Opponents of such steps to encourage more rapid deployment of ISDN might argue that, initially at least, it is aimed primarily at large users and that it would be unfair to burden ordinary ratepayers with upgrading the network in a way that

would favor such large users. In other words, they might favor long depreciation schedules to keep the cost of basic "dial-tone" service as low as possible. As noted at the colloquium, this issue of "who pays" for network upgrades is a critical one.

3. Should federal and state policymakers and regulators remove real or perceived statutory and regulatory barriers to development of the integrated broadband networks by the local exchange carriers?

An integrated broadband network would go a substantial step beyond the narrowband ISDN concept described immediately above. There are some concerns that the transmission speeds associated with narrowband ISDN are too slow and that the nation would be better off if the telephone companies jumped directly to broadband integrated networks instead. One obvious service that could be offered on such a network is video programming.

However, as pointed out by one of the policy experts at the colloquium, the Cable Communications Act of 1984 codified existing FCC rules that generally prohibited telephone companies from offering cable television services within their local service area. Local exchange carriers can provide broadband facilities (i.e., "channel service") to unaffiliated cable companies if they seek and are granted permission from the FCC to do so. However, in these situations, the local exchange carrier is prohibited from providing the actual program content. In addition, the BOCs are prohibited from offering information content by the terms of the Modification of Final Judgment that resulted from the settlement of the AT&T antitrust case. This means that they cannot select or market video programming or be partners with anyone providing video programming on their local network.

The FCC is addressing this telephone company/cable television cross-ownership issue in an ongoing proceeding and it has been the subject of congressional and Executive Branch interest as well. Generally speaking, groups and individuals opposing the cross-ownership restrictions argue that removing them would hasten the deployment of integrated, broadband fiber optic facilities in the local loop and increase the competition for existing cable television operators. Opponents argue that the local exchange carriers are prohibited only from providing information content (not integrated fiber facilities) and that the dangers of telephone company discrimination and cross-subsidization in their provision of cable services outweigh any perceived advantages of telephone company entry.

How this issue is ultimately resolved has obvious implications for the delivery of distance learning. If the restrictions are lifted and the proponents are correct, the cause of distance learning could be served by the more rapid deployment of integrated broadband facilities in the local network. Conceivably this could lead to a much richer collection of telephone company facility and service offerings. On the other hand, if the opponents are correct, telephone participation in content may result in cable television companies and others being driven out of business by abuses of the telephone companies' monopoly in local telephone service. Conceivably this could lead to less choice and less diversity in local distribution offerings.

4. Should state or local governments encourage alternative local fiber optic carriers to provide channel capacity that could be used for distance learning applications within a metropolitan area?

In most major metropolitan areas, non-telephone-company firms have installed or are now installing fiber optic networks to serve the specialized communications requirements of large customers. As noted by a participant in the colloquium, the District of Columbia is an example of an area now served by such a fiber carrier. The Institutional Communications Company is installing a fiber optic system to major points throughout the city, including a link to the Dulles Airport area. It is possible that these same fiber networks (or extensions of them) could be used to serve the broadband communications needs of the local schools. It is conceivable that the city could induce the company to offer such services on an advantageous basis or that it could require the provision of such service to the school district as a condition of gaining access to public streets and rights-of-way. This is not dissimilar to some cities' requirements that cable television companies provide services to local schools as a condition of their franchises.

5. Should enhanced or information service providers be exempt from the payment of federal/state access charges in order to encourage the development of services useful to educators?

According to FCC rules and regulations, enhanced service providers are entities that offer computerized electronic mail, voice messaging, information retrieval (such as teletext and audiotext) and similar services. Proliferation of such services could provide the "engine" for educational services for grades K-12 and for teachers and their in-service training. Such systems could (indeed, already do) give teachers,

librarians and other researchers access to a plethora of information "on-line." Likewise, the computer conference feature of many of these services can be utilized to provide courses to students using simple computer terminals. Computer-mediated systems have the advantages that (a) students can be geographically dispersed, (b) they can access the course material at their leisure, since it is stored in an on-line computer, (c) they can get feedback from the instructor using the electronic mail features of the system, and (d) the systems do not require costly upgrades to the telephone network or anything except a simple terminal.

There has been intense debate at the national level over whether these enhanced service providers should be subject to access charges and the issue is being addressed again in an FCC proceeding, Computer Inquiry III. Similar debates are likely to occur within state jurisdictions as well.

It may be in the long-term public interest to impose access charges on commercial enhanced service providers as a means of subsidizing basic telephone service, but, perhaps, non-commercial/educational providers should be exempt or even receive an additional discount for network usage from the local carrier. It might be useful to have federal legislation explicitly setting out that such discrimination is legal and desirable.

Similar language already exists in the Communications Act and the Public Broadcasting Act of 1967 for the transmission of educational and noncommercial services via satellite long-haul facilities. However, the FCC has since deregulated non-dominant long-haul services providers (including domestic satellite service providers) and competition and excess capacity has served to keep rates down in any event. As pointed out during the colloquium, this means that such a discount is obtainable, in effect, through marketplace arrangements rather than under a regulatory inducement. This raises a broader and more fundamental issue--whether the distance learning community would be better served in the long term by a competitive market rather than by hoping for an advantageous price from a carrier with monopoly power.

6. Are distance learning requirements for telecommunications facilities and services, especially for K-12, being properly articulated in state and federal telecommunications policy and regulatory arenas?

Many states are currently reevaluating the role of telecommunications in their jurisdictions and are changing the basic policies and statutes governing telecommunications regulation. The types, prices and terms and conditions of the offerings of telecommunications facilities and services that result from these studies and changes are apt to have a dramatic impact on the future of distance learning. Yet, it is far from clear whether the needs of the education community are being articulated--let alone being considered--in these deliberations. Hence, educators may be missing an important opportunity to influence the development and deployment of technology that could be very beneficial to education.

7. Would relieving the Bell Operating Companies of the Modified Final Judgment (MFJ) restrictions on the provision of information services encourage or discourage the development and deployment of cost-effective technologies useful for distance learning?

These restrictions, prohibiting the BOCs from providing information services, were designed to insure that the monopoly owner of the network would not also control the content and be able to unfairly compete with information service providers. For example, there was a fear that the BOCs would use their monopoly power over the local loop to cross-subsidize and otherwise discriminate in favor of their own information service operations; the BOCs might, for example, give their affiliated information service provider faster installation times or better quality lines. Opponents of lifting the restrictions argue that this is no idle concern because it was this type of behavior that was alleged in the AT&T antitrust case.

The BOCs, with the support of some government policymakers, are urging that they be relieved of the MFJ provisions that restrict their provision of information services. Indeed, legislation that would do just that has been introduced in the Congress. Recent changes in the decree do allow the BOCs to provide information "gateways" but not the actual information itself.

Many proponents argue that the development of information technology and information services will still be held back unless the content restrictions are lifted as well. Opponents argue that there are minor economies of scope in the provision of local exchange services and information content and that the dangers of anticompetitive behavior outweigh the advantages of changing the provision of the MFJ.

The technology that the BOCs are introducing to allow them to provide gateway services may ultimately be useful for distance learning. Educators need to examine this issue and consider whether allowing the BOCs to provide the information content would be beneficial to their interests or actually discourage the development of educational service providers. Substantial BOC investments in information services and technology may hasten the development of the technology, but innovative providers of distance learning software, for example, might be dissuaded from competing against a monopoly network operator who also offered such software.

8. Would removing regulatory and statutory barriers to the provision of two-way telecommunications and information services in local areas encourage cable television systems to offer broadband services useful in the provision of distance learning?

Most states still have regulatory or statutory barriers to competition in the local exchange area, although some states have started to remove such restrictions. As pointed out during the colloquium, Illinois allowed competition for local services beginning January 1, 1989. Other states have moved more cautiously and only allow competition in such services as high-speed digital transmission. Many states are examining in various proceedings the possibility of reducing or removing some of these barriers.

Proponents of removing the remaining regulatory and statutory barriers to local competition argue that competition is the best way to ensure the development of an advanced telecommunications infrastructure that will keep states and localities competitive in the information age. They argue that competition will ensure that the local exchange carriers are responsive to the needs of their customers. Opponents, on the other hand, argue that there may be economies of scale and scope in the provision of local telecommunications services and that diverting traffic from the local exchange carrier will serve only to raise the costs of local telephone service. They argue that the cause of universal service will be significantly harmed by such bypass of the local exchange carrier.

As pointed out in Section I, the public education community, together with other local and state agencies, represents a substantial amount of buying power that it can successfully exploit in an environment where there are competing suppliers. Several states which have used that purchasing power to create sophisticated statewide networks, according to colloquium speakers. Thus, the distance learning

community is in an excellent position to benefit from greater competition, but the possible long-term consequences of such bypass or preferential rates must be recognized.

9. Many state legislatures or regulatory commissions are also considering alternatives to traditional rate-of-return regulation. Typically these alternatives regulate price in some way rather than profit. Will these alternative forms of regulation encourage or discourage the provision of facilities and services that would be useful for distance learning?

Under traditional rate-of-return or rate-base regulation, utilities such as telephone companies are allowed to earn enough revenue to cover the expenses associated with providing their services plus a reasonable return on their net investment in the business. It is argued that this traditional form of regulation discourages efficiency. For example, since the regulated company can recover allowed expenses in the provision of services, its employees may not be as cost-conscious as they otherwise would be. That is, the company operates in what amounts to a "cost-plus" environment. Also, since the magnitude of the companies' total profits depend upon the size of their net investment, there may be an incentive to over-invest or "pad the rate base."

Under price-cap regulation, the regulators would not control the profit level but would instead cap the price of services for some period of time. Under this new form of regulation, it is argued that the carrier will have an incentive to control expenses and not over-invest since the resulting savings would accrue to the stockholders and not the ratepayers. On the other hand, the ratepayers would benefit from the moratorium on rate increases. There are various modifications to this basic scheme; the most prevalent perhaps is an arrangement whereby the increased profits generated by improved efficiency are shared between the utility's stockholders and the ratepayers.

The FCC recently adopted a price-cap system for AT&T and has proposed to extend a similar scheme to the interstate operations of the local exchange carriers. And, as noted above, many states are experimenting with similar approaches for intrastate services as well. These proposals have generated a considerable amount of controversy and apparently will have a significant long-term impact on the industry. The education community, like other users of telecommunications services, clearly would benefit from greater telephone company efficiency if the incentives work as planned. Others argue that price-cap systems will lead to

excessive profits by the telephone industry and that consumers would be better off under the traditional rate-of-return form of regulation. The pressures to reduce costs may decrease the carriers' present incentives to make facilities and services available to educational institutions at advantageous rates. On the other hand, in a competitive environment where the educational institutions have choices among several suppliers, the additional flexibility to reduce the prices of competitive services may benefit distance learning.

Regulated firms may also be more reluctant to make charitable contributions for educational purposes since they could no longer pass such contributions through to their ratepayers in the form of higher prices. The arguments surrounding price-caps are complex and the exact ramifications for the distance learning community are difficult to gauge. Nevertheless, the issue needs to be addressed since the consequences are apt to be significant.

C. Policy Issues That Arose During Colloquium Discussions

During the February 1989 colloquium sponsored by The Annenberg Washington Program, the assembled experts on distance learning were encouraged to put forth their own concerns about telecommunications policy issues that affect their field. Many of these concerns reflected, at least in part, the policy issues raised in Subsection B above. For example, there was concern expressed about the possible imposition of access charges on enhanced service providers and there was interest expressed in the possibility of preferential rates for certain on-line educational services. One participant expressed the need for policymakers to (a) encourage the interconnection of individual cable television systems throughout a metropolitan area or region and (b) develop policies regarding educational use of and access to cable television systems.

There was a significant amount of discussion of ways educators might aggregate their demand and thereby negotiate better rates in a competitive environment. One participant described how Iowa was able to aggregate statewide education traffic requirements, deriving considerable negotiating power. This enabled them to negotiate effectively with the local telephone company as well as with many alternative service providers in the state. It was also recognized that bypass of the telephone network by state government entities raises the broader issue of how smaller users will fare if large users leave the network.

This also led to lengthy discussions of the "make versus buy" or "lease versus buy" issue. In other words, participants raised the basic issue of whether educators

should try to create their own services by constructing or leasing the needed facilities--or buy services provided by existing carriers. Many other users of the telecommunications infrastructure are facing this same issue, which relates to the advantages of private versus public networks. While no clear consensus developed as to the best choice, there did seem to be a consensus that the distance learning community would be best served by continuing to have the choice. In other words, the participants would like the continued flexibility of being able to create their own private networks by leasing or owning their own facilities.

The private network alternatives depend upon (a) the presence of competitive facility providers, (b) the ability of users to build and operate their own facilities, and/or (c) the availability of reasonably priced dedicated facilities from the monopoly carrier if competitive providers are not present. Although outright prohibitions against private networks are unlikely, their economic viability can depend upon the cost allocation and pricing methods chosen by the carrier and approved by the regulators. This means that educators have a stake in federal and state proceedings dealing with these issues.

The distance learning specialists in the colloquium noted the need for comprehensive, integrated, long-range planning and realistic funding if educators are to take full advantage of the new opportunities. For example, it was pointed out that some states lack the statewide planning function necessary to take full, strategic advantage of the competitive marketplace. Some states were said to limit the period of time over which an educational organization can pay for some systems. Since some of the systems represent major infrastructure acquisitions, this suggests a possible need for revisions to procurement regulations and the need for flexibility on the part of the carriers.

However, despite the great importance of telecommunications policy issues in the future of distance learning, the overall consensus of the colloquium was that they are overshadowed by the broader issues of education policy. These education policy issues involve extremely complex questions of job security, teacher certification, union reactions and organizational responsibilities that must be resolved if distance learning is to reach its full potential.

IV. SUMMARY AND RECOMMENDATIONS

In this working paper, we have identified and discussed some of the major telecommunications policy and regulatory issues that can affect the development of the necessary infrastructure for the delivery of distance learning. Based upon this analysis, and recognizing the contributions of specialists who attended the colloquium, we have reached three principal conclusions: First, current and future advances in telecommunications technology hold great promise for facilitating the delivery of distance learning services. Second, because of increased competition among telecommunications suppliers, educators have a significantly increased opportunity to negotiate favorable prices and terms and conditions for the facilities, equipment and services they require. Third, because nearly all dimensions of telecommunications policy and regulation are being reexamined at the federal and state level, it is a critical time for educators in general, and the distance learning community in particular, to express their requirements to the telecommunications policy makers.

Based upon these three conclusions, we have three corresponding recommendations to make. First, educators should refine their requirements for distance learning and work closely with vendors and technology experts in doing so. They should do this in order to (a) influence the evolution of the technologies and services and (b) develop realistic expectations of the technology. Second, educators should reexamine and, if appropriate, revise their telecommunications procurement strategies to take full advantage of the evolving, increasingly competitive marketplace. Third, because telecommunications policy and regulation will continue to play a significant role in the further development of telecommunications facilities and services, educators should develop a better understanding of their stake in the relevant legislative and regulatory proceedings and then express their positions accordingly.

We believe that the involvement of the distance learning community at the state level is particularly important for three reasons articulated earlier in this working paper. First, many critical policy and regulatory issues have now shifted to the state level as competition and deregulation have gained a foothold at the federal level. Second, critical technology choices are being made at the local level regarding the future of local telecommunications services and facilities. ISDN, integrated broadband networks, and alternative fiber networks are examples of such choices. Third, responsibility for public education in the Unites States lies principally at the

state level, and thus policymakers and regulators at that level of government should be particularly sensitive to their concerns.

Participation in the policymaking at either the federal or state level can take many forms: participation in independent studies, informal meetings with key legislative and regulatory staff personnel, meeting with key legislators and regulators, formal testimony and comments in legislative and regulatory proceedings, and so forth. In many cases, educators may want to work within broader coalitions that share the same policy goals. Some states have special offices responsible for lobbying on behalf of individual ratepayers. In some cases these offices are located within the PUC, and in others they are located elsewhere in the state government. Educators may want to work with these offices to explain where they feel the public interest may lie on such issues as local network modernization. At the federal level, they may want to work with the National Telecommunications and Information Administration in its telecommunications policy advisory role. The important point here, however, is our basic recommendation--that educators get involved at this particularly critical juncture in the development of telecommunications policy.

V. PARTICIPANTS IN COLLOQUIUM

Workshop on Distance Learning, sponsored by The Annenberg Washington Program, convened in cooperation with the Office of Technology Assessment, U.S. Congress, February 16, 1989

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